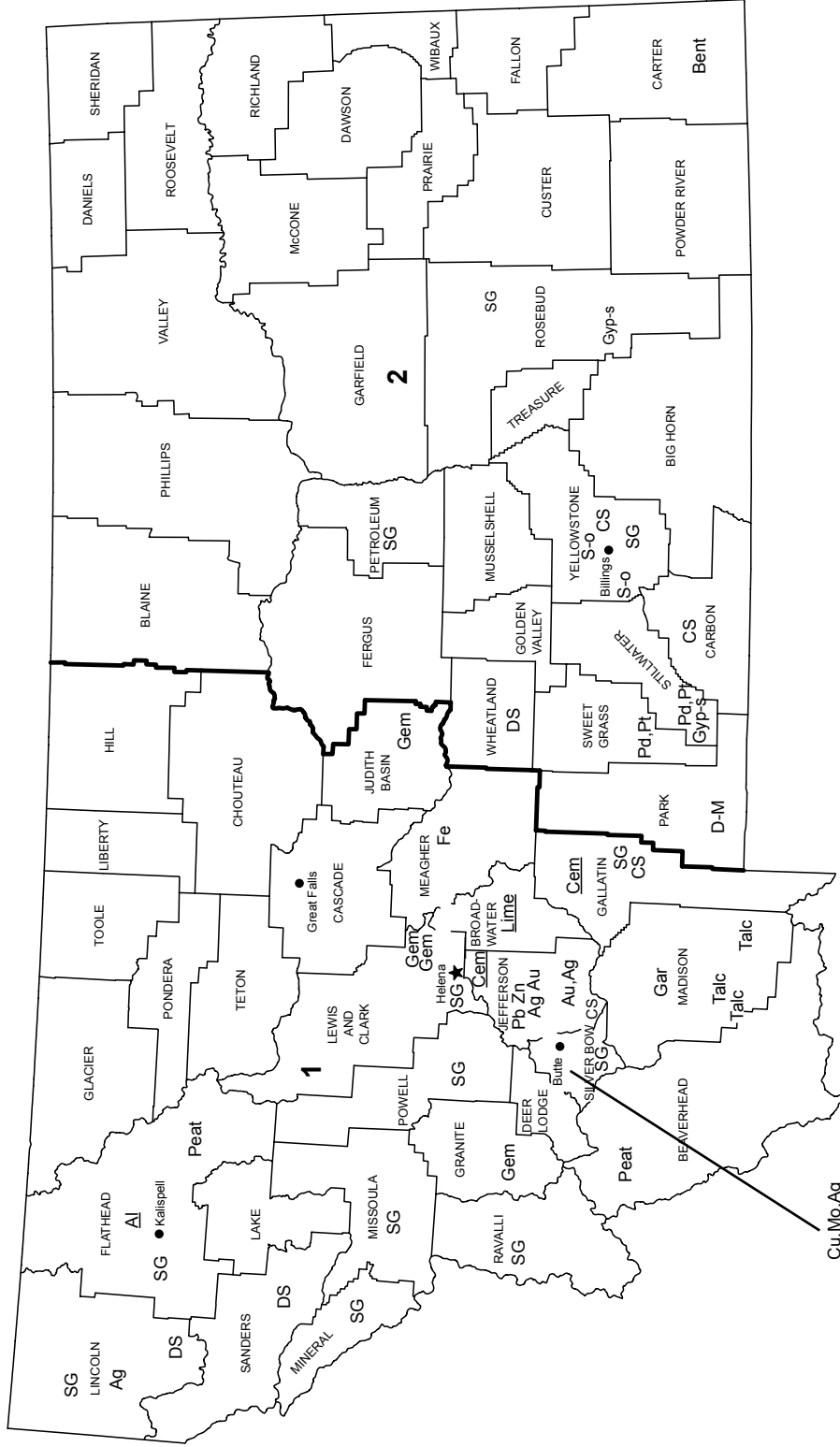


MONTANA



LEGEND

- County boundary
- ★ Capital
- City
- Crushed stone/sand and gravel districts

MINERAL SYMBOLS (Major producing areas)

Ag	Silver
Al	Aluminum plant
Au	Gold
Bent	Bentonite
Cem	Cement plant
CS	Crushed stone
Cu	Copper
D-M	Dimension marble
DS	Dimension stone
Fe	Iron
Gar	Garnet
Gem	Gemstones
Gyp-s	Synthetic gypsum
Lime	Lime plant
Mo	Molybdenum
Pb	Lead
Pd	Palladium
Peat	Peat
Pt	Platinum
S-o	Sulfur (oil)
SG	Construction sand and gravel
Talc	Talc
Zn	Zinc

THE MINERAL INDUSTRY OF MONTANA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Montana Bureau of Mines and Geology for collecting information on all nonfuel minerals.

In 2003, the estimated value¹ of nonfuel mineral production for Montana was \$492 million, based upon preliminary U.S. Geological Survey (USGS) data. This was an increase of about 4% compared with that of 2002² and followed an 18.1% decrease from 2001 to 2002. The State rose in rank to 26th from 28th among the 50 States in nonfuel raw mineral production value and accounted for more than 1% of the U.S. total.

Overall, metallic minerals accounted for nearly 63% of the State's total nonfuel mineral production value in 2003. By value, gold—with a doubling of production and higher average prices—overtook palladium as Montana's leading nonfuel mineral; lower overall prices for palladium contributed to the switch. These were followed by platinum, construction sand and gravel, cement (portland and masonry), and bentonite. In 2003, increases in the values of gold (most significantly), platinum, and construction sand and gravel (in descending order of change) led the way to the State's increase for the year. These increases in value more than offset a large drop in the value of palladium, which was the only nonfuel mineral with a significant drop in value for the year. By value, zinc, copper, lead, talc, silver, and crushed stone, although smaller, increased significantly (table 1).

In 2002, although platinum and construction sand and gravel production and values were up by nearly \$15 million and nearly \$9 million, respectively, the State's total nonfuel mineral production value significantly dropped owing largely to decreases in the values of palladium, which was down by \$75 million; gold, down by about \$27 million; and zinc. Despite the increase in palladium production of about 22%, the precious metal's value substantially dropped owing to the year's significantly lower average price. Decreases in the production and values of lead, silver, talc, crushed stone, and bentonite, although smaller, were significant. Although by value small in

¹The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 2003 USGS mineral production data published in this chapter are preliminary estimates as of July 2004 and are expected to change. For some mineral commodities, such as construction sand and gravel, crushed stone, and portland cement, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Specialist contact information may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals/contacts/comdir.html>; alternatively, specialists' names and telephone numbers may be obtained by calling USGS information at (703) 648-4000 or by calling the USGS Earth Science Information Center at 1-888-ASK-USGS (275-8747). All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—also may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

²Values, percentage calculations, and rankings for 2002 may differ from the Minerals Yearbook, Area Reports: Domestic 2002, Volume II, owing to the revision of preliminary 2002 to final 2002 data. Data for 2003 are preliminary and are expected to change; related rankings also may change.

comparison to most of the State's other nonfuel minerals, the value of gemstones increased by about 33% (table 1).

In 2003, Montana continued to be the only State to have primary palladium and platinum mine production and it increased in rank among the 50 States to 4th from 6th in the production of gold based upon USGS preliminary 2003 data. Additionally, the State remained first in the production of talc, second in bentonite, fourth in zinc and lead, and seventh in silver, and was a significant producer of construction sand and gravel. The State decreased to eighth from seventh in the production of gemstones based on value.

The Montana Bureau of Mines and Geology³ (MBMG) provided the narrative information that follows. Production and other data in the following text are those reported by the MBMG, based upon its own surveys and estimates. The data may differ from some production figures reported by the USGS.

Employment

Employment in the industry increased as Montana Resources (a copper and molybdenum producer in Butte) resumed production and Placer Dome Inc.'s Golden Sunlight Mine initiated a stripping program on the stage 5B expansion. (For more information, see "Gold" in the "Commodity Review" section).

Exploration and Mine Development

The mining and mineral industry improved significantly in 2003. After a decade of declining commodity prices, decreasing demand, and increasing costs, commodity prices, especially that of gold, started rising again to the level of the late 1980s. The reaction within the industry was rather cautious at first but started to respond with positive growth and investment decisions toward the end of 2003. Smaller- to medium-sized companies and especially new companies were able to interest investors in mineral opportunities and to shop for good inexpensive properties.

Copper and Silver.—The owner of the Montanore property was Mines Management, Inc. This copper-silver property, like Rock Creek, was being considered for future production. Although Noranda Inc. had a permit for the property, changes in the mine plan that will likely result from the change in ownership will require regulatory review and new permits.

Gold.—East of Missoula in the Garnet Mountains, an individual tested colluvial and gulch gold placers in First Chance Gulch. The tests recovered some gold in shallow ground covered with hand workings from the 1800s.

³Robin B. McCulloch, Associate Research Mining Engineer, authored the text of the State mineral industry information provided by the Montana Bureau of Mines and Geology.

The O.T. Mining Corporation continued geological mapping of the Ruby Mine area north of Butte. It identified the boundaries of a collapsed caldera and sampled high-grade breccia pipes that were the source of early mine production. Soil sampling indicated drilling targets in the northwestern portion of the property. An extensive geophysical program was slated for 2004. According to the company, its goal was to explore and delineate precious- and base-metal resources on the Ruby Property and then to sell these resources to a major mining company for development (The O.T. Mining Corporation, 2004⁴).

Elkhorn Goldfields (which was owned by Calim Private Equity, LLC of Aspen, CO) continued to drill the former Santa Fe Newmont gold properties in the Elkhorn Mountains east of Boulder. Results were good enough for the company to look into the possibility of building a mill.

South of Butte, Profile Resources Inc. completed rebuilding of the mill at Rochester. The company screened mine dumps from area mines and milled the fines. Its long-term goal was to produce ore from a property in the State and to provide custom milling for other small properties.

Near Virginia City, a private citizen completed a second year of work on the lower Brown's Gulch gold placer deposit. Pay gravels appeared to be about 3.7 meters (m) thick and 15 m wide and to maintain grades valued at more than \$131 per cubic meter. Much of the gold is coarse, and much of the deposit is covered with from 12 m to 15 m of organic clay and top soil.

In upper Alder Gulch, Moen Builders Inc. dug multiple trenches across the drainage in search of placer gold deposits. One hole was more than 15 m deep but contained uneconomic values.

Southeast of Big Timber, Lodestar Mining & Exploration developed three of its gold and platinum-group metal bearing ore zones. It reported ore stockpiles at the mine and mill and indicated that its gravity/flotation mill was completed, functional, and producing 113 metric tons per day (t/d) of concentrate. Lodestar was completing a refinery contract prior to reopening in May 2004.

Commodity Review

Industrial Minerals

Cement.—Northeast of Three Forks, Holcim (US) Inc. continued producing cement as it has for nearly 100 years. It applied for a permit to use waste tires as a replacement for 15% of its fuel source. If granted permission, the plant will consume the majority of tires in Montana's landfills, which will reduce the plant's operating costs and expand its position as a major recycler of waste material. Holcim used broken colored glass that formerly went into landfills as a supplementary raw material for producing its cement.

Crushed Stone.—West of Townsend, Graymont Western US Inc. maintained steady production of burnt lime. Prices

and demand have been steady to slightly increasing. With resumption of mining and processing around the State and region, demand and markets were expected to expand in 2004.

Gemstones.—Yogo Creek Mining Co. mined, cut, and mounted sapphires from its property southwest of Utica. It developed a water jet for mining the clay-rich ore with a 12,000-pound-per-square-inch water spray. This innovation resulted in a decreased mining rate but an increased production rate because of less damage to the stones from blasting. The company also constructed a new building for sorting and shipping.

Talc.—South of Ennis, the Yellowstone talc mine, which was owned by Luzenac America Inc. and was located near Cameron, produced talc. Continuing efforts were made to optimize production and to minimize costs.

East of Dillon, Barretts Minerals Inc. maintained production at the Regal and Treasure Mines. Production during 2003 was 60% from the Treasure and 40% from the Regal. During the year, the company purchased the surface lands of the Regal and developed infrastructure for future production. Included in the purchase was the establishment of powerlines for three-phase-power and dewatering wells. Barretts Minerals planned to reroute the county road in 2004. The company noted that the demand for talc was increasing.

Metals

Copper and Molybdenum.—In Butte, Montana Resources resumed production of copper and molybdenum from the Continental Pit. While the mill appeared to be functioning well, full production was down owing to the difficulty in obtaining mining equipment. The company anticipated purchasing five new trucks during the coming season. About 70% of its more-than-300-person work force was new hires. Montana Resources completed a new water treatment plant at the end of 2003 to treat water from some of its inactive leach pads.

Gold.—At Placer Dome Inc.'s Golden Sunlight Mine, record gold production that exceeded 7,000 kilograms (kg) was achieved. The board of directors approved the stage 5B expansion⁵ after preliminary results of the supplementary draft environmental impact statement (EIS) indicated that pit backfill would be undesirable because of the potential detrimental effects on the environment. Consequently, the underground mining was completed, the mill was closed for repairs, and the pit underwent a 900,000-metric-ton (t) stripping program. Ore production was expected to resume in June 2005 and will run through 2008.

Lead and Zinc.—North of Boulder, Apollo Gold Corp.'s Montana Tunnels Mine continued production of gold, lead, silver, and zinc from a diatreme-hosted deposit. The company installed a larger crusher as part of its mill productivity expansion. The grades of lead and zinc increased as Apollo Gold continued to strip to the existing pit floor. Significant progress was made in push-backs of the west and east pit walls. The company had completed the first phase of the tailings dam expansion and had 4 years of reserves; a potential for 4

⁴A reference that includes a section mark (§) is found in the Internet Reference Cited section.

⁵The mine can revert from an underground mine to an open pit mine, which will help extend the mine life by about 4 years.

additional years existed should permits be granted to push back the north wall.

Platinum-Group Metals.—Located near Columbus, Stillwater Mining Co. established a new board of directors after Norimet Limited purchased a 55.4% interest in the company. At yearend, Stillwater reported a loss of \$331.5 million, which included a noncash asset impairment charge of \$390.3 million (\$234.3 million after tax) and a noncash charge of \$78.6 million to reduce the carrying value of deferred tax assets to realizable value. For 2003, the company produced a total of 18,200 kg of palladium and platinum, which was down by 5% from the previous year.

Of the company's two mines, production at the Stillwater Mine was down by 9% from last year to 13,300 kg of platinum and palladium. Cash production costs were down slightly to \$262 per troy ounce; most of the improvements were made in the fourth quarter. Stillwater's mine grade increased slightly to 14 grams per metric ton (g/t) platinum-group metals, and production decreased slightly to 1,800 t/d.

At the East Boulder Mine, the grade was steady at 14 g/t platinum and palladium. Mill recovery was up slightly to 89%, and a total of 4,850 kg of platinum and palladium was produced during the year. Cash operating costs decreased by 10% to \$343 per troy ounce with a higher production rate of 1,130 t/d. The mine personnel established a production goal of 1,450 t/d for 2004 as demand for major development projects was starting to decrease.

Environmental Issues

An initiative campaign supported by private individuals, companies, and suppliers was started to repeal the ban on cyanide extraction of gold. This ban targeted only ores mined by open pit methods. Ores mined by underground methods have

always been able to use any of the cyanide extraction methods available.

In the northwest corner of the State, Revette Silver (formerly Sterling Mining Co.) initiated a drilling program to expand its reserve base. Activities at the mine site indicated that the company was taking a serious look at reopening the mine. With copper/silver prices at a decadal high, the mine was expected to resume production. The Rock Creek copper/silver deposit, which is located 19 kilometers southeast of the Troy Mine, was owned by Revette Silver; the deposit was formerly owned by Grupo Mexico, S.A. de C.V. During the permitting process, the U.S. Forest Service approved the company's request to construct a mine; however, Revette Silver expected that some environmental groups might oppose it.

Government Programs

The MBMG studied mining, minerals, ground water, and geology. Products for the year included a ground-water report on the Middle Yellowstone River Basin. Geologic mapping continued with Federal matching funding from the STATEMAP program, a component of the USGS National Cooperative Geologic Mapping Program (NCGMP). Under the STATEMAP program, 9 quadrangles (1:100,000) were released in digital form, which completed most of the 94 quadrangles. A total of 20 open-file reports, which ranged from geologic maps to the origin of sapphires; 1 pamphlet; 1 report of investigation; and 1 special publication on gold placer evaluation techniques were produced.

Internet Reference Cited

The O.T. Mining Corporation, 2004, The O.T. Mining Corporation, accessed September 28, 2004, at URL <http://www.otmining.com>.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN MONTANA^{1,2}
(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2001		2002		2003 ^P	
	Quantity	Value	Quantity	Value	Quantity	Value
Clay, bentonite	252	16,200	181	14,900	181	14,900
Gemstones	NA	320	NA	424	NA	426
Lead ³ metric tons	7,290	7,020	W	W	W	W
Palladium ³ kilograms	12,100	237,000	14,800	162,000	14,600	98,300
Platinum ³ do.	3,610	61,900	4,390	76,500	4,100	86,500
Sand and gravel, construction	14,600	67,200	16,700	76,000	18,000	81,900
Stone:						
Crushed	3,070	12,400	2,370	10,000	2,500	10,800
Dimension	9	2,400	12	2,620	12	2,520
Zinc ³ metric tons	22,600	21,900	W	W	W	W
Combined values of cement, clays (common), copper (2003), garnet (industrial), gold, lime, molybdenum concentrates (2000), peat, silver, talc (crude), and values indicated by symbol W	XX	149,000	XX	129,000	XX	197,000
Total	XX	575,000	XX	471,000	XX	492,000

^PPreliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

¹Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

²Data are rounded to no more than three significant digits; may not add to totals shown.

³Recoverable content of ores, etc.

TABLE 2
MONTANA: CRUSHED STONE SOLD OR USED, BY KIND¹

Kind	2001				2002			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	6	1,760	\$7,500	\$4.27	5	1,400	\$6,280	\$4.47
Granite	3	W	W	3.65	3	W	W	3.64
Sandstone and quartzite	3	584	2,120	3.64	3	203	738	3.64
Traprock	2	W	W	4.14	2	W	W	4.09
Volcanic cinder and scoria	3	W	W	3.58	3	82	338	4.13
Miscellaneous stone	8	91	352	3.87	5	44	158	3.58
Total or average	XX	3,070	12,400	4.06	XX	2,370	10,000	4.23

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

¹Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

TABLE 3
MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Concrete aggregate (+1 1/2 inch), riprap and jetty stone	W	W	\$6
Coarse aggregate graded:			
Concrete aggregate coarse	(2)	(2)	4.41
Bituminous aggregate	(2)	(2)	3.64
Total or average	78	\$315	4.04
Coarse and fine aggregate, unpaved road surface	W	W	3.64
Agricultural limestone	W	W	12.98
Chemical and metallurgical, lime manufacture	W	W	6.05
Special, mine dusting or acid water treatment	W	W	5.50
Other miscellaneous uses and specified uses not listed	124	486	3.93
Unspecified: ³			
Reported	436	1,540	3.53
Estimated	1,140	4,320	3.80
Total or average	1,570	5,860	3.73
Grand total or average	2,370	10,000	4.23

W Withheld to avoid disclosing company proprietary data; included in "Grand total."

¹Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

²Withheld to avoid disclosing company propriety data, included in "Total."

³Reported and estimated production without a breakdown by end use.

TABLE 4
MONTANA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse aggregate (+1 1/2 inch) ²	W	W	W	W	--	--
Coarse aggregate, graded ³	W	W	W	W	--	--
Coarse and fine aggregates ⁴	W	W	--	--	--	--
Agricultural ⁵	W	W	W	W	--	--
Chemical and metallurgical ⁶	W	W	W	W	--	--
Special ⁷	W	W	--	--	--	--
Other miscellaneous uses and specified uses not listed	--	--	124	486	--	--
Unspecified:⁸						
Reported	435	1,540	--	--	1	4
Estimated	1,010	3,850	128	465	--	--
Total	1,910	8,120	458	1,900	1	4

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes riprap and jetty stone.

³Includes concrete aggregate (coarse) and bituminous aggregate (coarse).

⁴Includes unpaved road surfacing.

⁵Includes agricultural limestone.

⁶Includes lime manufacture

⁷Includes mine dusting or acid water treatment.

⁸Reported and estimated production without a breakdown by end use.

TABLE 5
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002,
BY MAJOR USE CATEGORY¹

Use	Quantity	Value (thousands)	Unit value
	(thousand metric tons)		
Concrete aggregate (including concrete sand)	1,180	\$6,130	\$5.21
Plaster and gunite sands	3	15	5.00
Concrete products (blocks, bricks, pipe, decorative, etc.)	8	66	8.25
Asphaltic concrete aggregates and other bituminous mixtures	893	4,040	4.53
Road base and coverings ²	2,940	13,200	4.50
Fill	217	599	2.76
Snow and ice control	147	1,090	7.41
Other miscellaneous uses	96	715	7.45
Unspecified:³			
Reported	4,790	22,100	4.61
Estimated	6,500	28,000	4.33
Total or average	16,700	76,000	4.54

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes road and other stabilization (cement).

³Reported and estimated production without a breakdown by end use.

TABLE 6
MONTANA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products ²	918	4,410	270	1,790	--	--
Asphaltic concrete aggregates and road base materials ³	2,530	12,200	628	2,380	677	2,640
Fill	W	W	W	W	--	--
Snow and ice control	W	W	W	W	22	81
Other miscellaneous uses	397	2,190	42	135	--	--
Unspecified: ⁴						
Reported	300	1,310	3,510	16,300	987	4,530
Estimated	5,000	22,000	1,500	6,100	--	--
Total	9,160	42,100	5,900	26,700	1,690	7,250

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes plaster and gunite sands.

³Includes road and other stabilization (cement).

⁴Reported and estimated production without a breakdown by end use.